CAN MATTER AND RADIATION BE REGARDED AS TWO ASPECTS OF THE SAME WORLD-CONDITION ?

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The present writer has recently put forward the view [Roy. Soc. Proc. A, Vol. 126, (1929), p. 35] that a material entity when viewed by an observer travelling with the velocity of light would be recognised by him as radiation, and has suggested that radiation would be interpreted by the same observer as a material phenomenon. These views were based on an investigation of the geometrical relationship between the Heaviside ellipsoids characterising the "particle" aspect of an electron and the de Broglie wave surfaces characterising its wave aspect. This relationship is described by the identity:

(1) $$\varphi(x, y, z, t) \equiv x^2 + y^2 + z^2 - c^2 t^2 + [W(x, y, z, t)]^2 / m_o^2 c^2$$

where $\varphi(x, y, z, t) = $ constant, and $W(x, y, z, t) = $ constant, represent the Heaviside ellipsoids and the de Broglie surfaces respectively. In another paper [Roy. Soc. Proc. A. Vol. 131, (1931), p. 335] an attempt is made to include material and radiational waves under one and the same scheme of fundamental relations. The Maxwellian equations of electrodynamics are derived from the set of relations:

(2)
$$\begin{cases} \dfrac{\partial E_\mu}{\partial x_\nu} = \cos(n\, x_\nu)\, A_\mu\ , \quad \mu, \nu = 1, 2, 3 \\[2ex] \dfrac{\partial E_\mu}{\partial t} = \theta\, A_\mu \qquad\qquad , \quad \mu = 1, 2, 3. \end{cases}$$

where (E_1, E_2, E_3) are the components of the electric field, and A, n, θ are two vectors and a scalar quantity, respectively, associated with the existence of a material or radiational entity. If A and n are in the same direction, the entity is recognised as a proton, if in opposite directions as an electron, and if mutually perpendicular, as a photon. Accordingly radiation would correspond to a mid-way position, so to speak, between positive and negative electricity. The derivation of the set of relations (2) is now discussed. It is shown that for a simple polarised entity possessing a uniform electric amplitude, such as plane-polarised radiation or a uniformly moving electron, the set is reducible to a system of identities. It is suggested that all material and radiational entities are built up of such simple entities in a manner corresponding to the building up of the wave function from a series of simple harmonic terms. It is pointed out that this would leave the validity of the classical equations of electrodynamics unimpaired on a macroscopic scale, but would render them invalid on the microscopic scale.